 <p><b>MOTION IMAGERY STANDARDS BOARD</b></p> <p><b>STANDARD</b></p> <p><b>Motion Imagery Sensor Minimum Metadata Set</b></p>	<p><b>MISB ST 0902.7</b></p> <p><b>22 February 2018</b></p>
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## 1 Scope

This standard defines the Motion Imagery Sensor Minimum Metadata Set (MISMMS), which enables the basic capabilities of Situational Awareness, Discovery & Retrieval, and Cross-Domain Dissemination. In addition, the standard provides direction on the encoding of the MISMMS for low-bitrate to high-bitrate scenarios to support a transition path from analog systems towards all digital Motion Imagery Systems.

## 2 References

- [1] MISB ST 0601.12 UAS Datalink Local Set, Feb 2018.
- [2] MISB MISP-2018.2 Motion Imagery Standards Profile, Feb 2018.
- [3] MISB ST 0107.2 Bit and Byte Order for Metadata in Motion Imagery Files and Streams, Feb 2014.
- [4] MISB ST 0102.11 Security Metadata Universal and Local Sets for Digital Motion Imagery, Oct 2014.
- [5] MISB ST 1204.1 Motion Imagery Identification System (MIIS) Core Identifier, Oct 2013.

## 3 Acronyms

<b>BER</b>	Basic Encoding Rules
<b>D&amp;R</b>	Discovery and Retrieval
<b>FoV</b>	Field of View
<b>HAE</b>	Height above Ellipsoid
<b>ISR</b>	Intelligence, Surveillance and Reconnaissance
<b>KLK</b>	Key Length Value
<b>LS</b>	Local Set
<b>MFG</b>	Metadata Focus Group
<b>MIIS</b>	Motion Imagery Identification System
<b>MISB</b>	Motion Imagery Standards Board
<b>MISMMS</b>	Motion Imagery Sensor Minimum Metadata Set
<b>MISP</b>	Motion Imagery Standards Profile
<b>MSL</b>	Mean Sea Level

<b>NATO</b>	North Atlantic Treaty Organization
<b>NGA</b>	National Geospatial-Intelligence Agency
<b>NIAT</b>	NGA Interoperability Action Team
<b>NTB</b>	NITF Technical Board
<b>SA</b>	Situational Awareness
<b>STANAG</b>	Standardization Agreement
<b>TLV</b>	Tag Length Value
<b>UL</b>	Universal Label
<b>USCENTCOM</b>	U.S. Central Command

## 4 Revision History

Revision	Date	Summary of Changes
0902.7	02/22/2018	<ul style="list-style-type: none"> <li>Added Tag count and byte count to Tables 2, 4 and 6</li> <li>Added more informative information to Annex B: Tables 3-9 updated/added</li> <li>Updated Tag values in Tables 10 &amp; 11 to be consistent with ST 0601.12</li> <li>Added statement before Tables 10 &amp; 11 regarding precision of example values</li> <li>Updated references [1], [2]</li> </ul>

## 5 Introduction, Intent, and General Implementation Rules

The MISMMS consists of metadata elements from MISB ST 0601 [1], which enable the baseline functionality required for Discovery & Retrieval / Cross-Domain Dissemination of source imagery and the Situational Awareness Product for ISR mission accomplishment as defined in the MISP [2].

The initial MISMMS was developed jointly by the Motion Imagery Standards Board (MISB), the NITFS Technical Board (NTB), the NGA Interoperability Action Team (NIAT), and the Metadata Focus Group (MFG) with additional subject matter expert input from U.S. Central Command (USCENTCOM), NATO Standardization Agreement (STANAG) 4586, and the Unmanned Systems community.

As Motion Imagery systems begin to migrate to all-digital architectures, some systems in transition still require the consistent preservation of certain analog system characteristics. This standard identifies how to encode the source-derived metadata from a Motion Imagery sensor into a MISB KLV metadata set.

## 6 Motion Imagery Sensor Minimum Metadata Set

The MISMMS is a Local Set profile of MISB ST 0601 with all elements mandatory unless conditionally dependent.

Requirement(s)	
ST 0902.3-01	All metadata shall be expressed in accordance with MISB ST 0107 [3].
ST 0902.3-02	The MISMMS shall use MISB ST 0601 [1] Local Set 16-byte Universal Key (06.0E.2B.34.02.0B.01.01.0E.01.03.01.01.00.00.00 (CRC 56773)) for its implementation.
ST 0902.3-03	The elements of the MISMMS as defined in MISB ST 0902 Table 1 shall be populated in accordance with MISB ST 0601 requirements.
ST 0902.3-04	All metadata elements contained in the MISMMS shall be reported no less than once every thirty (30) seconds under all circumstances.

Please refer to MISB ST 0601 [1] for further information on each element. Of interest, Tag 48 of MISB ST 0601 contains a nested security Local Set as defined in MISB ST 0102 [4]. Please refer to MISB ST 0102 for further information regarding each security element. MISB ST 0601 also contains reference to a Motion Imagery Core Identifier as defined in MISB ST 1204 [5]. Please refer to MISB ST 1204 for further information regarding the Motion Imagery Core Identifier.

**Note 1:** Platform Pitch Angle (Tag 6 | 90), Platform Roll Angle (Tag 7 | 91), Sensor True Altitude as MSL (Tag 15) | Sensor Ellipsoid Height as HAE (Tag 75) | Sensor Ellipsoid Height Extended as HAE (Tag 104), Frame Center Elevation as MSL (Tag 25) | Frame Center Height Above Ellipsoid (Tag 78), and Target Width (Tag 22) | Target Width Extended (Tag 96) are governed by an “inclusive or” within MISB ST 0601 with one exception. The use of Tag 75 and Tag 104 is governed by an “exclusive OR.”

**Note 2:** A Motion Imagery Core Identifier (Tag 94) is required as the Motion Imagery data is disseminated from the “system”, where the system is the composite of the platform and control station (*i.e.* Ground Control Station).

## 6.1 Local Set Elements

The MISMMS elements are listed in Table 1, which has the following column designations:

- **Tag** is the Local Set tag number for the element in the MISMMS.
- **Element Name** is the name of the element.
- **Range & Units** provides the allowed range and unit of specification for the value.
- **Type** indicates the data type of the element.
- **Length** is the number of bytes allowed for the element.

**Table 1: Summary of MISMMS Tags**

Tag	Element Name	Range & Units	Type	Length (Bytes)
1	Checksum	None	uint16	2
2	Precision Time Stamp	Microseconds	uint64	8
3	Mission ID	None	ISO 646	variable
5	Platform Heading Angle	0-360 Degrees	uint16	2
6   90	Platform Pitch Angle (Short)	+/- 20 Degrees	int16	2
	Platform Pitch Angle (Full)	+/- 90 Degrees	int32	4

## ST 0902.7 Motion Imagery Sensor Minimum Metadata Set

7	Platform Roll Angle (Short)	+/- 50 Degrees	int16	2
91	Platform Roll Angle (Full)	+/- 90 Degrees	int32	4
10	Platform Designation	None	ISO 646	variable
11	Image Source Sensor	None	ISO 646	variable
12	Image Coordinate System	None	ISO 646	variable
13	Sensor Latitude	+/- 90 Degrees	int32	4
14	Sensor Longitude	+/- 180 Degrees	int32	4
15	Sensor True Altitude (MSL)	-900 to 19000m	uint16	2
75	Sensor Ellipsoid Height (HAE)	-900 to 19000m	uint16	2
104	Sensor Ellipsoid Height Extended (HAE)	-900 to 40000m	IMAPB	2
16	Sensor Horizontal FoV	0 to 180 Degrees	uint16	2
17	Sensor Vertical FoV	0 to 180 Degrees	uint16	2
18	Sensor Relative Azimuth Angle	0 to 360 Degrees	uint32	4
19	Sensor Relative Elevation Angle	+/- 180 Degrees	int32	4
20	Sensor Relative Roll Angle	0 to 360 Degrees	uint32	4
21	Slant Range	0 to 5000000 m	uint32	4
22	Target Width	0 to 10000 m	uint16	2
96	Target Width Extended	0 to 1500000 m	IMAPB	3
23	Frame Center Latitude	+/- 90 Degrees	int32	4
24	Frame Center Longitude	+/- 180 Degrees	int32	4
25	Frame Center Elevation (MSL)	-900 to 19000 m	uint16	2
78	Frame Center Height Above Ellipsoid (HAE)			
48/1	Security Classification	Look Up Table	uint8	1
48/2	Classifying Country & Releasing Instructions Country Coding Method	Look Up Table	uint8	1
48/3	Classifying Country	None	ISO 646	variable
48/4	Security-SCI/SHI Information	None	ISO 646	variable
48/5	Caveats	None	ISO 646	variable
48/6	Releasing Instructions	None	ISO 646	variable
48/12	Object Country Coding Method	Look Up Table	uint8	1
48/13	Object Country Codes	None	UTF-16	variable
48/22	Security Metadata Version	Integer	uint16	2
65	UAS Local Set Version	Integer	uint8	1
94	Motion Imagery Core Identifier	None	binary	50

## 7 Annex A: Recommended MISMMS Element Frequency – Informative

This section addresses the presence and frequency of individual data elements within the MISMMS.

Some metadata elements change more frequently than others. When sending metadata in bandwidth-constrained environments, it is more efficient to transmit only the dynamic items (“Dynamic”) with frequently changing values, and the less dynamic, constant items (“Constant”)

less often. This section provides guidance in the form of a “*recommended update rate*” for each element of the MISMMS.

Some of the security metadata elements may be omitted as they are conditional. Further direction on this topic is found in MISB ST 0102.

Recommendation Summary for MISMMS Frequency (see Table 2):

1. Include Tags 3, 10, 11, 12, 48 sub-tags & 94 once every 10 seconds
2. Include all other elements as often as possible, within the available bandwidth and up to the frame rate

The rate at which “Dynamic” items update varies depending on the available bandwidth of the system, and how frequently the metadata values are refreshed. In some systems, it is desirable to have metadata updated for each Motion Imagery frame. For a specific worked example, see Annex B: Example MISMMS Element Rate Calculations – Informative.

Note: It is not mandatory that each metadata packet contain every metadata element; Annex B demonstrates the viability of transmitting the MISMMS in a bandwidth-constrained environment. Given sufficient bandwidth other metadata packet configurations (*e.g.* more packets each containing fewer elements) are permissible.

**Table 2: Recommended Update Rate for MISMMS Elements**

Tag #	Tag Name	Max Length (Bytes)	Rec Update Interval
1	Checksum	2	Fast
2	Precision Time Stamp	8	Fast
3	Mission ID	127	10 s
5	Platform Heading Angle	2	Fast
6	Platform Pitch Angle (Short)	2	Fast
90	Platform Pitch Angle (Full)	4	Fast
7	Platform Roll Angle (Short)	2	Fast
91	Platform Roll Angle (Full)	4	Fast
10	Platform Designation	127	10 s
11	Image Source Sensor	127	10 s
12	Image Coordinate System	127	10 s
13	Sensor Latitude	4	Fast
14	Sensor Longitude	4	Fast
15	Sensor True Altitude (MSL)	2	Fast
75	Sensor Ellipsoid Height (HAE)	2	
104	Sensor Ellipsoid Height Extended (HAE)	2	
16	Sensor Horizontal FoV	2	Fast
17	Sensor Vertical FoV	2	Fast
18	Sensor Relative Azimuth Angle	4	Fast
19	Sensor Relative Elevation Angle	4	Fast
20	Sensor Relative Roll Angle	4	Fast
21	Slant Range	4	Fast
22	Target Width	2	Fast
96	Target Width Extended	3	Fast
23	Frame Center Latitude	4	Fast
24	Frame Center Longitude	4	Fast
25	Frame Center Elevation (MSL)	2	Fast
78	Frame Center Height Above Ellipsoid (HAE)	2	
48/1	Security Classification	1	10 s
48/2	Classifying Country & Releasing Instructions Country Coding Method	1	10 s
48/3	Classifying Country	6*	10 s
48/4	Security-SCI/SHI Information	40*	10 s
48/5	Caveats	32*	10 s
48/6	Releasing Instructions	40*	10 s
48/12	Object Country Coding Method	1	10 s
48/13	Object Country Codes	40*	10 s
48/22	Security Metadata Version	2	10 s
65	UAS Local Set Version	1	Fast
94	Motion Imagery Core Identifier	50	10 s
39	Tags	Total	797

**Note 3:** \* indicates the maximum length for these elements are only representative for the example in Appendix B as MISB ST 0102 does not define a maximum length.

## 8 Annex B: Example MISMMS Element Rate Calculations – Informative

This section provides bandwidth budget calculations, assuming a 9600 bits-per-second channel for metadata.

Calculations are presented for two general scenarios:

1. Scenario 1: Assumes all content is always present in each KLV packet
2. Scenario 2: Assumes content is present at variable rates in each KLV packet

### 8.1 Scenario 1: All Content Always Present

#### 8.1.1 Worst Case

In Table 3 the bandwidth usage for the worst case of this scenario is computed, which includes all tags from Table 2 in every packet.

**Table 3: Example bandwidth computation for worst-case usage**

Items	Bytes	Comments
Local Set Key	16	
Local Set Length	2	
Tags	39	Each Tag is 1 byte
Tag's Length	39	Each Length is 1 byte
Tag's Payload	797	See Table 2
Security Set Tag	1	1-byte Tag not shown in table
Security Set Length	2	2 bytes, since Security Set is larger than 127 bytes (per BER-OID)
Total	896	Bytes
Total	7168	Bits
Total with overhead	8960	Serial overhead is 1 Start bit and 1 Stop bit per byte

With serial transmission overhead, 8960 bits will enable one metadata update-per-second at 9600 bits-per-second.

#### 8.1.2 Typical Case

As shown in Table 4, to reduce bandwidth a typical case will limit strings to 20 bytes, eliminate Tags 6, 7, 15, 22, 25 & 75, and reduce the MIIS to 34 bytes.

**Table 4: Typical case for Scenario 1**

Tag #	Tag Name	Length (Bytes)
1	Checksum	2
2	Precision Time Stamp	8
3	Mission ID	20
5	Platform Heading Angle	2
90	Platform Pitch Angle (Full)	4
91	Platform Roll Angle (Full)	4
10	Platform Designation	20
11	Image Source Sensor	20
12	Image Coordinate System	20
13	Sensor Latitude	4
14	Sensor Longitude	4
104	Sensor Ellipsoid Height Extended (HAE)	2
16	Sensor Horizontal FoV	2
17	Sensor Vertical FoV	2
18	Sensor Relative Azimuth Angle	4
19	Sensor Relative Elevation Angle	4
20	Sensor Relative Roll Angle	4
21	Slant Range	4
96	Target Width Extended	3
23	Frame Center Latitude	4
24	Frame Center Longitude	4
78	Frame Center Height Above Ellipsoid (HAE)	2
48/1	Security Classification	1
48/2	Classifying Country & Releasing Instructions Country Coding Method	1
48/3	Classifying Country	6
48/4	Security-SCI/SHI Information	20
48/5	Caveats	20
48/6	Releasing Instructions	20
48/12	Object Country Coding Method	1
48/13	Object Country Codes	20
48/22	Security Metadata Version	2
65	UAS Local Set Version	1
94	Motion Imagery Core Identifier	34
33	Tags	Total 269

Table 5 computes the bandwidth usage for the typical case of this scenario, which includes all tags from Table 4 in every packet.

**Table 5: Example bandwidth computation for typical-case usage**

Items	Bytes	Comments
Local Set Key	16	
Local Set Length	2	
Tags	33	Each Tag is 1 byte
Tag's Length	33	Each Length is 1 byte
Tag's Payload	269	See Table 4
Security Set Tag	1	1-byte Tag not shown in table
Security Set Length	1	1 byte, since Security Set is smaller than 128 bytes (per BER-OID)
Total	355	Bytes
Total	2840	Bits
Total with overhead	3550	Serial overhead is 1 Start bit and 1 Stop bit per byte

With serial transmission overhead, 3550 bits will enable two metadata updates per second at 9600 bits per second.

## **8.2 Scenario 2: Content Present at Variable Rates**

If the data rates of individual metadata elements are varied, there are more options. One option is to define two different metadata lists: Dynamic and Constant. Dynamic metadata is the subset of metadata where values change frequently -- see elements listed as “Fast” in the “Rec Update Interval” column of Table 2. Constant metadata values do not change very often. From these subsets, two KLV sets are used: Dynamic set and Dynamic-plus-Constant. The Dynamic set is transmitted as fast as possible, while the Dynamic-plus-Constant set is only transmitted every 30 seconds to meet the metadata requirements. The Dynamic-plus-Constant set for this example is the same as the Typical Case from Scenario 1, and for this example, will be the “Full-Typical” set. Table 6 lists the elements of the Dynamic set for this example scenario.

**Table 6: Dynamic-only metadata**

Tag #	Tag Name	Length (Bytes)
1	Checksum	2
2	Precision Time Stamp	8
5	Platform Heading Angle	2
90	Platform Pitch Angle (Full)	4
91	Platform Roll Angle (Full)	4
13	Sensor Latitude	4
14	Sensor Longitude	4
104	Sensor Ellipsoid Height Extended (HAE)	2
16	Sensor Horizontal FoV	2
17	Sensor Vertical FoV	2
18	Sensor Relative Azimuth Angle	4
19	Sensor Relative Elevation Angle	4
20	Sensor Relative Roll Angle	4
21	Slant Range	4
96	Target Width Extended	3
23	Frame Center Latitude	4
24	Frame Center Longitude	4
78	Frame Center Height Above Ellipsoid (HAE)	2
65	UAS Local Set Version	1
19	Tags	Total 64

Table 7 shows the bandwidth usage computed for the dynamic metadata in this scenario, which includes all tags from Table 6 in every packet.

**Table 7: Example bandwidth computation for Dynamic metadata**

Items	Bytes	Comments
Local Set Key	16	
Local Set Length	1	
Tags	19	Each Tag is 1 byte
Tag's Length	19	Each Length is 1 byte
Tag's Payload	64	See Table 2
Total	119	Bytes
Total	952	Bits
Total with overhead	1190	Serial overhead is 1 Start bit and 1 Stop bit per byte

Table 8 shows rate calculations for this scenario when the Full-Typical metadata combine with the dynamic metadata over a 10 second interval.

**Table 8: Rate Calculation for Dynamic & Full-Typical Packets**

Description	Totals
Bits / 10 s Interval @ 9600 bits per second	96000
1 packet of Full-Typical bits with Serial Overhead	3550
Bits Remaining after Full-Typical Packet	92450
Bits used with Dynamic packet with Serial Overhead	1190
Possible Dynamic Packets / 10 s Interval in Bits Remaining	77.689
Whole Dynamic Packets / 10 s Interval in Bits Remaining	77

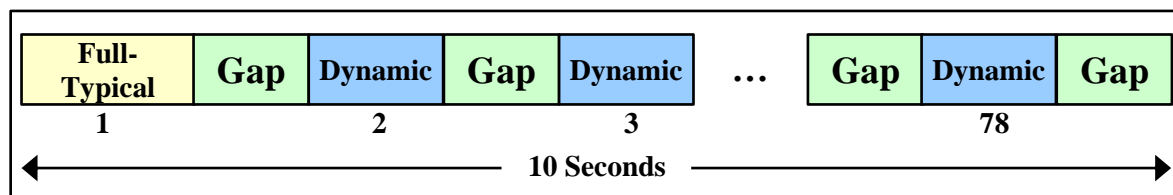
That is, in a 10-second interval, it is possible to send one Full-Typical MISMMS packet followed by 77 Dynamic MISMMS packets.

If each packet (Dynamic or Full-Typical) is separated by an equal-sized gap in time, then the rate calculations are as shown in Table 9:

**Table 9: Rate Calculation for Dynamic & Full-Typical Packets with Gaps**

Description	Totals
Whole Dynamic Packets / 10 s	77
Bits / 10 s @ 9600 bits per second	96000
Bits / 77 Dynamic Packets	91630
Bits / 1 Full-Typical Packet	3550
Bits Remaining	820
# of Gaps	78
Bits / Gap	10.51282
Gap Time @ 9600 bps (microseconds)	1095.085

This packet schedule repeats every 10 seconds (see Figure 1):



**Figure 1: Time Interval with Dynamic Packets and Gaps**

## 9 Annex C: Example MISMMS Data Packets – Informative

This section constructs hypothetical example MISMMS data packets and presents the encoding. All values shown in Table 10 are for illustration purposes only. The Tag-Length-Value (TLV) encoded data are shown as hexadecimal bytes. Programmer's Note: The “Interpretation” of the “Value” is shown in full precision, beyond a tag’s resolution so programmers can verify they are using the right formulas. The number of significant digits expressed is determined as follows:

- 1) Based on the dynamic range and the precision needed the number of bits in an integer is determined.
- 2) The precision, and the maximum value determines the type of value to use (single precision float vice double).

The type of value determines the number of digits (7 to 9 for single, 15 to 17 for double) needed. 9 and 17 digits account for any rounding issues in the final digits. The final one or two digits may be different for different compiler optimization/hardware.

**Table 10: Example “Dynamic & Constant” MISMMS Packet Data**

Tag #	Tag Name	Value	Interpretation	TLV Hex Bytes
2	Precision Time Stamp	1,231,798,102,000,000 microseconds	Mon Jan 12 2009 22:08:22	02 08 00 04 60 50 58 4E 01 80
3	Mission ID	Mission 12	Mission 12	03 0A 4D 69 73 73 69 6F 6E 20 31 32
5	Platform Heading Angle	0x71C2	159.974365 Degrees	05 02 71 C2
6	Platform Pitch Angle (Short)	0xFD3D	-0.431531724 Degrees	06 02 FD 3D
7	Platform Roll Angle (Short)	0x08B8	3.40586566 Degrees	07 02 08 B8
10	Platform Designation	Predator	Predator	0A 08 50 72 65 64 61 74 6F 72
11	Image Source Sensor	EO Nose	EO Nose	0B 07 45 4F 20 4E 6F 73 65
12	Image Coordinate System	Geodetic WGS84	Geodetic WGS84	0C 0E 47 65 6F 64 65 74 69 63 20 57 47 53 38 34
13	Sensor Latitude	0x5595B66D	60.176822966978335 Degrees	0D 04 55 95 B6 6D
14	Sensor Longitude	0x5B5360C4	128.42675904204452 Degrees	0E 04 5B 53 60 C4
15	Sensor True Altitude (MSL)	0xC221	14190.7195 Meters	0F 02 C2 21
16	Sensor Horizontal FoV	0xCD9C	144.571298 Degrees	10 02 CD 9C
17	Sensor Vertical FoV	0xD917	152.643626 Degrees	11 02 D9 17
18	Sensor Rel. Az. Angle	0x724A0A20	160.71921143697557 Degrees	12 04 72 4A 0A 20
19	Sensor Rel. El. Angle	0x87F84B86	-168.79232483394085 Degrees	13 04 87 F8 4B 86
20	Sensor Rel. Roll Angle	0x7DC55ECE	176.86543764939194 Degrees	14 04 7D C5 5E CE
21	Slant Range	0x03830926	68590.983298744770 Meters	15 04 03 83 09 26

## ST 0902.7 Motion Imagery Sensor Minimum Metadata Set

22	Target Width	0x1281	722.819867 Meters	16 02 12 81
23	Frame Center Lat.	0xF101A229	-10.542388633146132 Degrees	17 04 F1 01 A2 29
24	Frame Center Lon.	0x14BC082B	29.157890122923014 Degrees	18 04 14 BC 08 2B
25	Frame Center El. (MSL)	0x34F3	3216.03723 Meters	19 02 34 F3
48/1	Security Classification	0x01	UNCLASSIFIED//	01 01 01
48/2	Classifying Country and Releasing Instructions Country Coding Method	0x07	STANAG-1059 Three Letter	02 01 07
48/3	Classifying Country	//USA	//USA	03 05 2F 2F 55 53 41
48/4	Security-SCI/SHI Information	<None>	<None>	
48/5	Caveats	<None>	<None>	
48/6	Releasing Instructions	<None>	<None>	
48/12	Object Country Coding Method	0x07	STANAG-1059 Three Letter	0C 01 07
48/13	Object Country Codes	\u0055\u0053\u0041	USA	0D 06 00 55 00 53 00 41
48/22	Security Metadata Version	10	MISB Standard 0102.10	16 02 00 0A
65	UAS Local Set Version	0x06	MISB Standard 0601.6	41 01 06
94	Motion Imagery Core Identifier			5E 22 01 70 F5 92 F0 23 73 36 4A F8 AA 91 62 C0 0F 2E B2 DA 16 B7 43 41 00 08 41 A0 BE 36 5B 5A B9 6A 36 45
1	Checksum	0xAA43	0xAA43	01 02 AA 43

The TLV bytes are appended end-to-end, and together form the Value portion of the encompassing KLV packet. In the “Dynamic & Constant” packet, there are 210 bytes of TLV data – encoded as the length of the KLV packet. Lengths up to 127 bytes are encoded in BER short form. Lengths of 128 bytes or greater are encoded in BER long form. In this case, 210 bytes are encoded as the BER long form length of 0x81D2.

The Local Set begins with its 16-byte UL key, followed by the length of the data set (0x81D2), which is then followed by the TLV triplets listed above in order. In hex, the complete MISMMS “Dynamic & Constant” example KLV packet is:

## ST 0902.7 Motion Imagery Sensor Minimum Metadata Set

06	0E	2B	34	02	0B	01	01	0E	01	03	01	01	00	00	00
81	D2	02	08	00	04	60	50	58	4E	01	80	03	0A	4D	69
73	73	69	6F	6E	20	31	32	05	02	71	C2	06	02	FD	3D
07	02	08	B8	0A	08	50	72	65	64	61	74	6F	72	0B	07
45	4F	20	4E	6F	73	65	0C	0E	47	65	6F	64	65	74	69
63	20	57	47	53	38	34	0D	04	55	95	B6	6D	0E	04	5B
53	60	C4	0F	02	C2	21	10	02	CD	9C	11	02	D9	17	12
04	72	4A	0A	20	13	04	87	F8	4B	86	14	04	00	00	00
00	15	04	03	83	09	26	16	02	12	81	17	04	F1	01	A2
29	18	04	14	BC	08	2B	19	02	34	F3	30	1C	01	01	01
02	01	07	03	05	2F	2F	55	53	41	0C	01	07	0D	06	00
55	00	53	00	41	16	02	00	0A	41	01	06	5E	22	01	70
F5	92	F0	23	73	36	4A	F8	AA	91	62	C0	0F	2E	B2	DA
16	B7	43	41	00	08	41	A0	BE	36	5B	5A	B9	6A	36	45
01	02	AA	43												

	Key (16 byte SMPTE Universal Label)
	Length (BER long form)
	Length (BER short form)
	Tag (Local Set Identifier)
	Value (Interpretation depends on tag data type)
	Grid Patterned Colors (Denotes nested metadata Set)

The next example, which uses the values in Table 11, illustrates the details of a hypothetical “Dynamic Only” MISMMMS data packet. Programmer’s Note: The “Interpretation” of the “Value” is shown in full precision, beyond a tag’s resolution so programmers can verify they are using the right formulas.

**Table 11: Example “Dynamic Only” MISMMMS Packet Data**

Tag #	Tag Name	Value	Interpretation	TLV Hex Bytes
2	Precision Time Stamp	1,231,798,102,000,000 microseconds	Mon Jan 12 2009 22:08:22	02 08 00 04 60 50 58 4E 01 80
5	Platform Heading Angle	0x71C2	159.974365 Degrees	05 02 71 C2
6	Platform Pitch Angle (Short)	0xFD3D	-0.431531724 Degrees	06 02 FD 3D
7	Platform Roll Angle (Short)	0x08B8	3.40586566 Degrees	07 02 08 B8
13	Sensor Latitude	0x5595B66D	60.176822966978335 Degrees	0D 04 55 95 B6 6D
14	Sensor Longitude	0x5B5360C4	128.42675904204452 Degrees	0E 04 5B 53 60 C4
15	Sensor True Altitude (MSL)	0xC221	14190.7195 Meters	0F 02 C2 21
16	Sensor Horizontal FoV	0xCD9C	144.571298 Degrees	10 02 CD 9C
17	Sensor Vertical FoV	0xD917	152.643626 Degrees	11 02 D9 17
18	Sensor Rel. Az. Angle	0x724A0A20	160.71921143697557 Degrees	12 04 72 4A 0A 20
19	Sensor Rel. El. Angle	0x87F84B86	-168.79232483394085 Degrees	13 04 87 F8 4B 86
20	Sensor Rel. Roll Angle	0x7DC55ECE	176.86543764939194 Degrees	14 04 7D C5 5E CE
21	Slant Range	0x03830926	68590.983298744770 Meters	15 04 03 83 09 26
22	Target Width	0x1281	722.819867 Meters	16 02 12 81
23	Frame Center Lat.	0xF101A229	-10.542388633146132 Degrees	17 04 F1 01 A2 29
24	Frame Center Lon.	0x14BC082B	29.157890122923014 Degrees	18 04 14 BC 08 2B
25	Frame Center El. (MSL)	0x34F3	3216.03723 Meters	19 02 34 F3

## ST 0902.7 Motion Imagery Sensor Minimum Metadata Set

65	UAS Local Set Version	0x06	MISB Standard 0601.6	41 01 06
1	Checksum	0xC850	0xC850	01 02 C8 50

Again, the TLV triplets are appended end-to-end; together they form the Value portion of the encompassing KLV packet. In the “Dynamic Only” packet, there are 97 bytes of TLV data – encoded as the length of the KLV packet. As the length of 97 bytes is less than 128 bytes, it is encoded as the BER short form length of 0x61.

The Local Set begins with its 16-byte UL key, followed by the length 0x61, which is then followed by all the TLV triplets as listed above in order. In hex, the complete MISMMS “Dynamic Only” example KLV packet is:

06	0E	2B	34	02	0B	01	01	0E	01	03	01	01	00	00	00
61	02	08	00	04	60	50	58	4E	01	80	05	02	71	C2	06
02	FD	3D	07	02	08	B8	0D	04	55	95	B6	6D	0E	04	5B
53	60	C4	0F	02	C2	21	10	02	CD	9C	11	02	D9	17	12
04	72	4A	0A	20	13	04	87	F8	4B	86	14	04	00	00	00
00	15	04	03	83	09	26	16	02	12	81	17	04	F1	01	A2
29	18	04	14	BC	08	2B	19	02	34	F3	41	01	06	01	02
C8	50														

Legend

Key (16 byte SMPTE Universal Label)

Length (BER long form)

Length (BER short form)

Tag (Local Set Identifier)

Value (Interpretation depends on tag data type)

## 10 Annex D: Basis for Metadata Inclusion in MISMMS – Informative

This section provides motivation for the inclusion of each item in the MISMMS. Please note that the metadata tags enumerated herein constitute the threshold set to meet two primary ISR missions: Discovery & Retrieval (D&R) and ISR Situational Awareness (ISR SA). The D&R mission refers to storage of Motion Imagery within an archive, and subsequent search and access to the archive. Users needing additional elements are encouraged to use other elements from MISB ST 0601, or other MISB metadata elements as appropriate.

ISR SA as defined in the MISB is “the human perception of the elements of the operational environment in the context of the forces, space, and time, the comprehension of their meaning, and the projection of their status in the near future.” SA is subjective; it is perhaps easier to define a SA Product in objective terms.

The MISB defines a SA Product as “a concise, transportable summary of the state of friendly and enemy elements conveyed through information such as Motion Imagery, imagery, or other data that can contribute to the development of SA either locally or at some distant node.”

In other words, a SA Product is a collection of those objectives – quantifiable pieces of information that assist someone in the formations of SA for a specific context. In the context of ISR, a SA Product answers three questions regarding an asset: *who* is it, *where* is it, and *what* is it doing?

Elements from MISB ST 0601 have been chosen as needed to support the D&R and ISR SA tasks as follows:

**Checksum (Tag 1):** This element is necessary to ensure the data contained in an instance of a MISB ST 0601 Local Set has not been corrupted during transmission.

**Precision Time Stamp (Tag 2):** This element is necessary as it indicates the time for which all other elements in each MISB ST 0601 Local Set are valid – geospatial information must have a temporal component.

**Mission ID (Tag 3):** This element is the basis for many D&R queries.

**Platform Heading / Platform Pitch / Platform Roll (Tags 5, 6 | 90, 7 | 91):** These elements define the orientation of an airborne asset, which can be used to predict its future position.

**Platform Designation (Tag 10):** This element supports both D&R queries and ISR SA regarding the presence of friendly assets.

**Image Source Sensor (Tag 11):** As some platforms have multiple sensors, information that indicates what sensor is used refines the information included under Platform Designation (Tag 10) for both D&R and ISR SA.

**Image Coordinate System (Tag 12):** Defines a reference coordinate system for all measurements related to the Earth. It is an essential element in clearly defining measurements such as latitude, longitude, elevation, altitude, etc. fundamental to D&R and ISR SA.

**Sensor Latitude / Sensor Longitude / Sensor Altitude (Tags 13, 14, 15 | 75):** These elements define the position of the active sensor and can be combined with Platform heading / pitch / roll to predict future position of the sensor.

**Sensor Field of View-Horizontal / Sensor Field of View-Vertical (Tags 16-17):** These two elements define the size of the field-of-view of the active sensor. This supports D&R queries related to pixel resolution of the target, and ISR SA by assisting in defining the area of interest for the asset.

**Sensor Relative Azimuth Angle / Sensor Relative Elevation Angle / Sensor Relative Roll Angle (Tags 18-20):** When combined with Platform heading / pitch / roll, these elements comprise the composite pointing vector of the sensor, which is a key component of ISR SA.

**Slant Range (Tag 21):** While this information can be derived from other information regarding the position & orientation of the platform along with a terrain model, an independent measurement of the slant range to the target (or image center) improves confidence in the position knowledge.

**Target Width (Tag 22):** This element provides the analyst a quick reference of scale and ground sample distance of a primary object within the viewing area. It is a component of ISR SA.

**Frame Center Latitude / Frame Center Longitude / Frame Center Elevation (Tags 23, 24, 25 | 78):** These elements give the center-point of the imaging sensor (which, when combined with the field-of-view elements, define where the sensor is pointing) in support of D&R queries.

**Security Classification / Classifying Country & Releasing Instructions Country Coding Method / Classifying Country / SCI-SHI Information / Caveats / Releasing Instructions (Tags 48/1-48/6):** Classification information is required by D&R systems to determine appropriate distribution limits. This is a fundamental requirement of all data in the NSG.

**Object Country Coding Method / Object Country Code (Tags 48/12-48/13):** These elements support a fundamental D&R query regarding the country being imaged and support security / releasability decisions.

**Security Metadata Version (Tag 48/22):** This element ensures proper interpretation of the elements that comprise the security Local Set as the standard evolves over time.

**UAS Local Set Version (Tag 65):** This element ensures proper interpretation of the elements that comprise the UAS Datalink Local Set as the standard evolves over time.

**Motion Imagery Core Identifier (Tag 94):** This element is a unique identifier for sensor data based upon the composite collection system and enables enterprise management of Motion Imagery data.